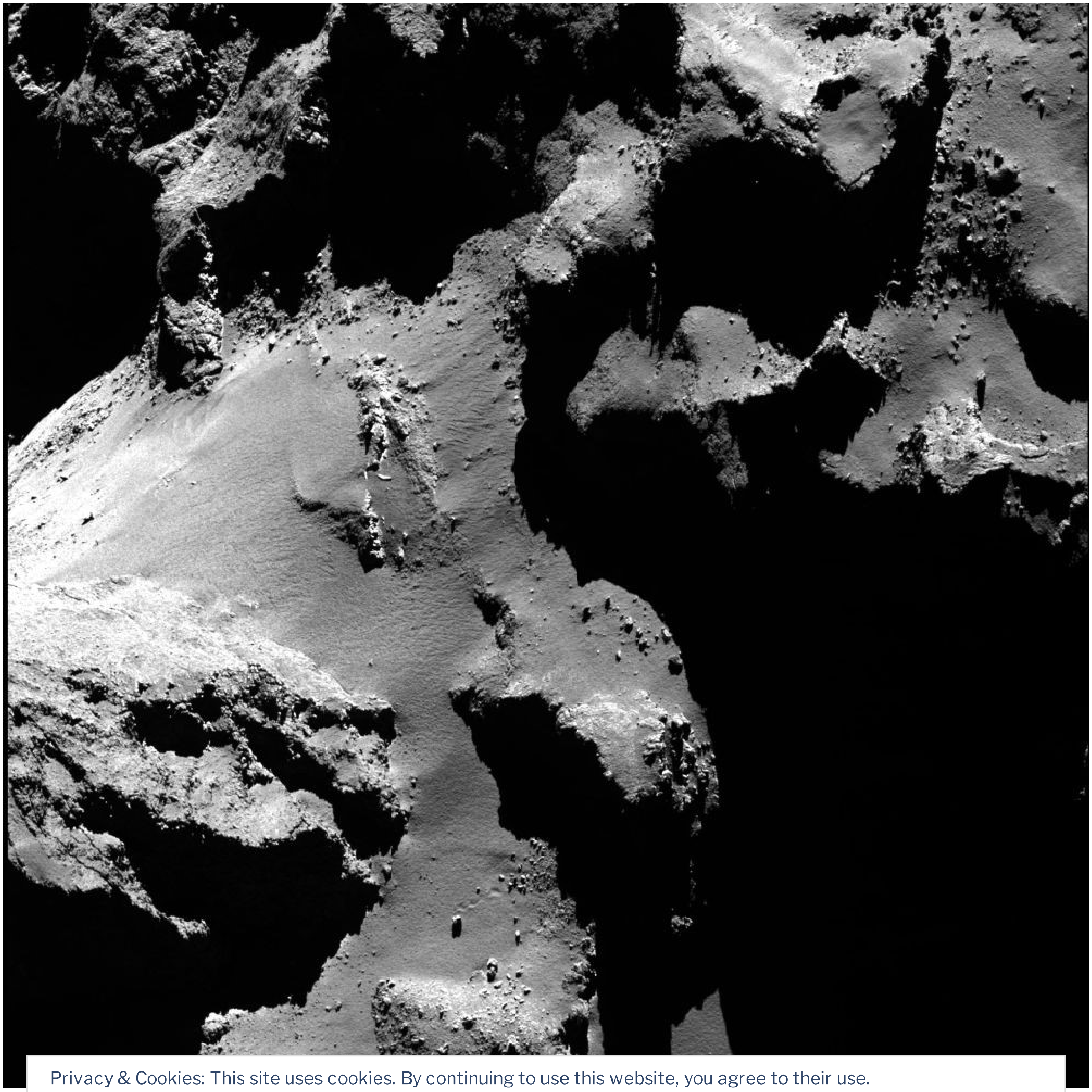
UNIVERSE TODAY

Space and astronomy news



Rosetta Saw Collapsing Cliffs and Other Changes on 67P During its Mission

It seems that comet 67P/Churyumov–Gerasimenko is not the stoic, unchanging Solar System traveller that it might seem to be. Scientists working through the vast warehouse of images from the Rosetta spacecraft have discovered there's lots going on on 67P. Among the activity are collapsing cliffs and bouncing boulders.

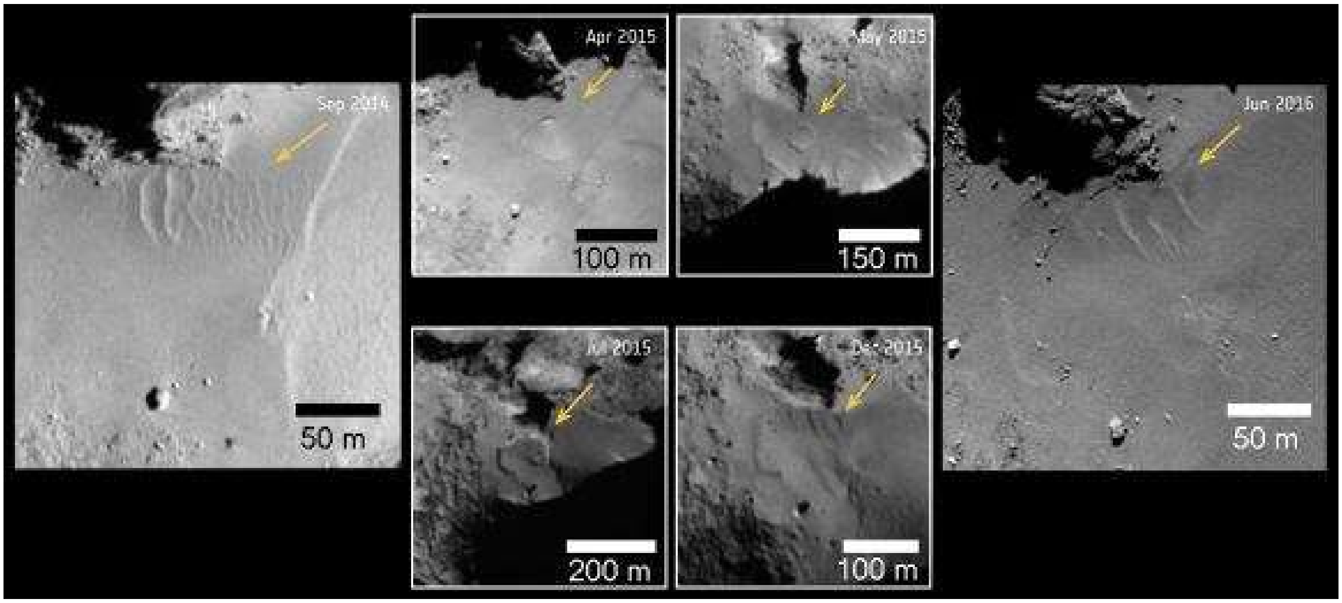
Rosetta spent almost two years at 67P, ending its mission with a hard landing on the comet's surface. During the spacecraft's journey and its two years at the comet, it captured almost 100,000 images. About 3/4 of them are from OSIRIS (Optical, Spectroscopic, and Infrared Remote Imaging System) and the rest are from the NAVCAM. (You can enjoy archives of its images here.)

These images are all being analyzed by scientists, and part of that analysis involves images from during and after perihelion. Perihelion is when an object is closest to the Sun, and scientists expect to see the most changes on the comet during that time. By comparing perihelion images with those following perihelion, they hope to gain a better understanding of how the comet evolves.

'Rosetta's datasets continue to surprise us…"

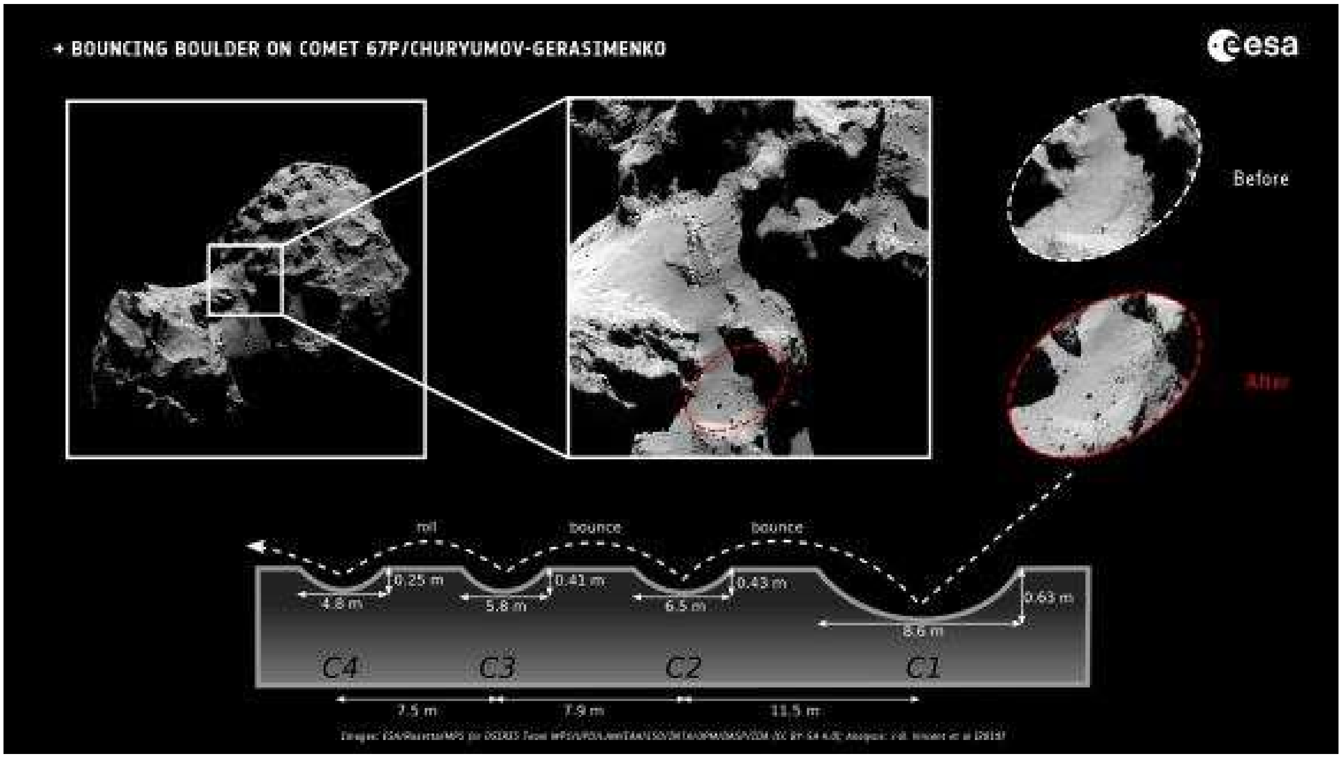
Matt Taylor, ESA's Rosetta Project Scientist.

There's a lot going on 67P's surface. A fracture in the comet's neck region grew, patterns of circular shapes in smooth terrain changed over time, sometimes growing up to a few meters per day. There were also boulders moving across the surface. Some of them were tens of meters across and moved hundreds of meters. Other boulders left the surface completely and were ejected into space.



Dune-like features that were identified early in Rosetta's mission in the neck region of Comet 67P/Churyumov–Gerasimenko changed over two years (first and last images). In addition, numerous circular scarp-like features were seen to develop and fade over time (central set of images). The circular features reached a diameter of 100 m in less than three months before subsequently fading away again, giving rise to a new set of ripples.
The arrows point to the approximately location of the ripple and scarp features to help guide the eye between images. Image Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

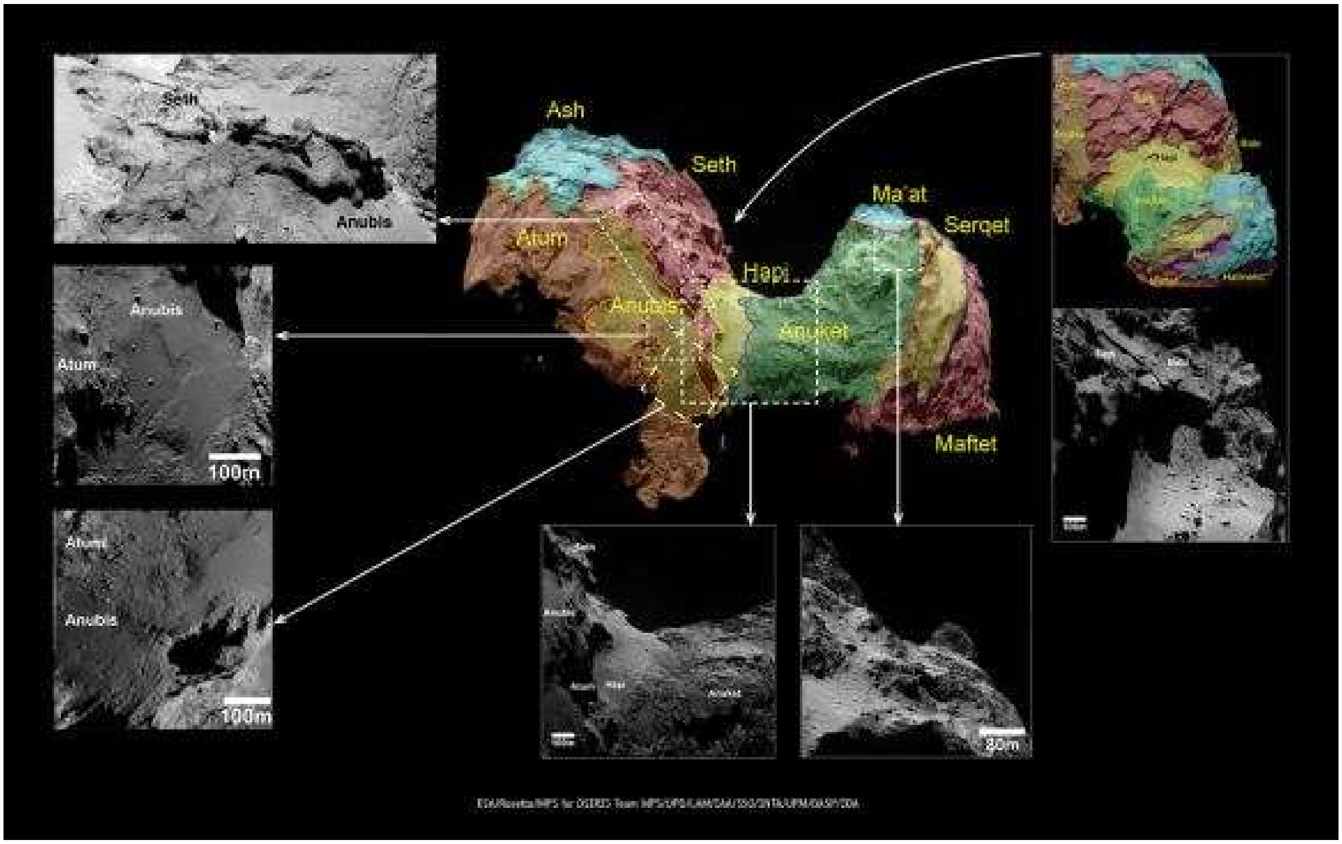
Comet 67P is made of two lobes with a smooth neck connecting them. Over the course of Rosetta's mission the neck region underwent a lot of changes. Images show a 10 meter boulder that fell from a cliff and rolled and bounced along the smooth surface, leaving a trail of bounce marks in the soft material.



<Click to Enlarge> This image details the movement of one boulder on the surface of comet 67P. Image Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA (CC BY-SA 4.0); Analysis: J-B. Vincent et al (2019)

"We think it fell from the nearby 50 m-high cliff, and is the largest fragment in this landslide, with a mass of about 230 tonnes," said Jean-Baptiste Vincent of the DLR Institute for Planetary Research, who presented the results at the EPSC-DPS conference in Geneva today.

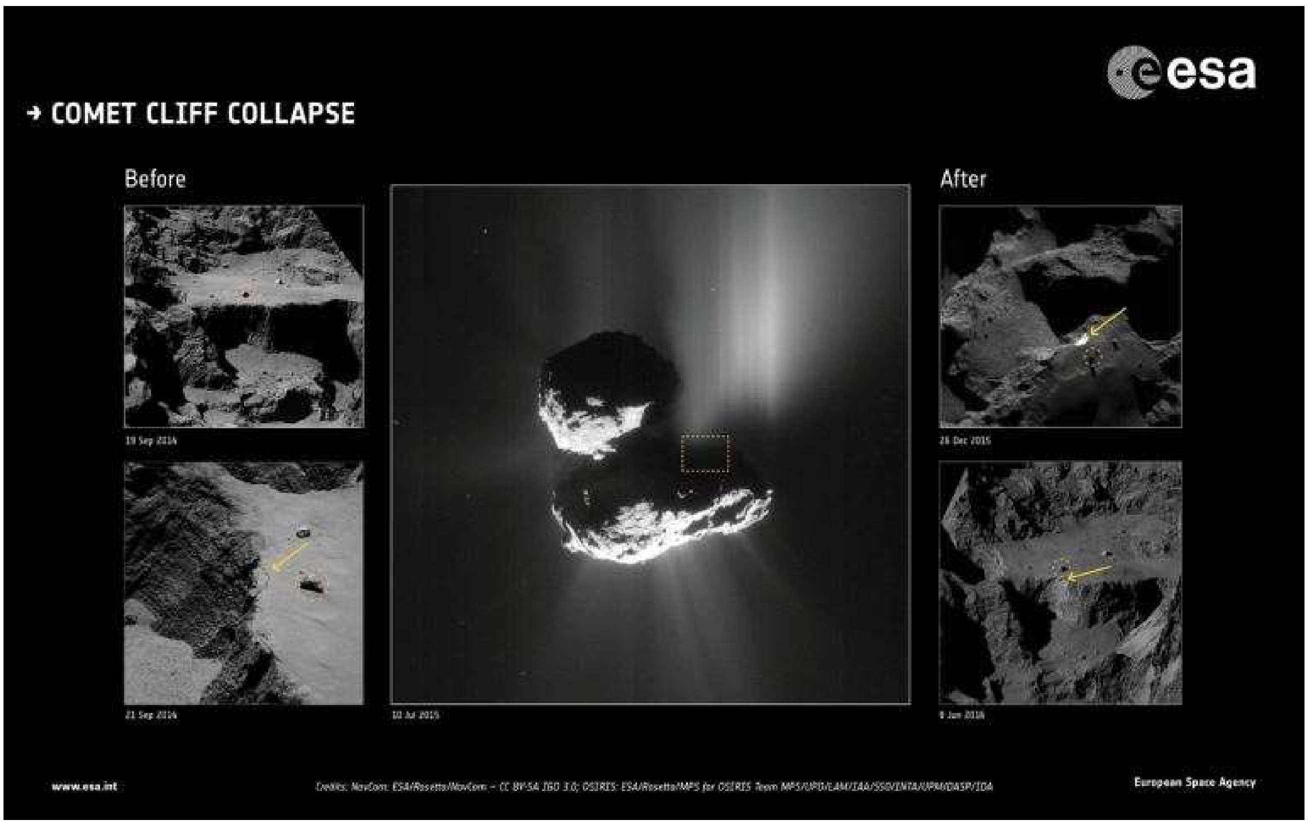
resolution to exactly pinpoint the 'before' location of the boulder," Vincent said in a press release.



Comet 67P with the names given to the surface regions. The Hapi region is of particular interest because its smooth, connects both of the comet's lobes, and has a very active surface. Image Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

Calling it a boulder may be a little misleading. Comet 67P's material is much weaker compared with ice and rock on Earth. Boulders on the comet are about 100 times weaker than packed snow is here on Earth. But studying them on different locations on the comet's surface gives clues to the properties of the boulders themselves, and of the material they land on.

OSIRIS images also show cliffs collapsing at different locations on the comet. One of those collapses involved a 70 meter wide segment of the Aswan cliff falling in July 2015.

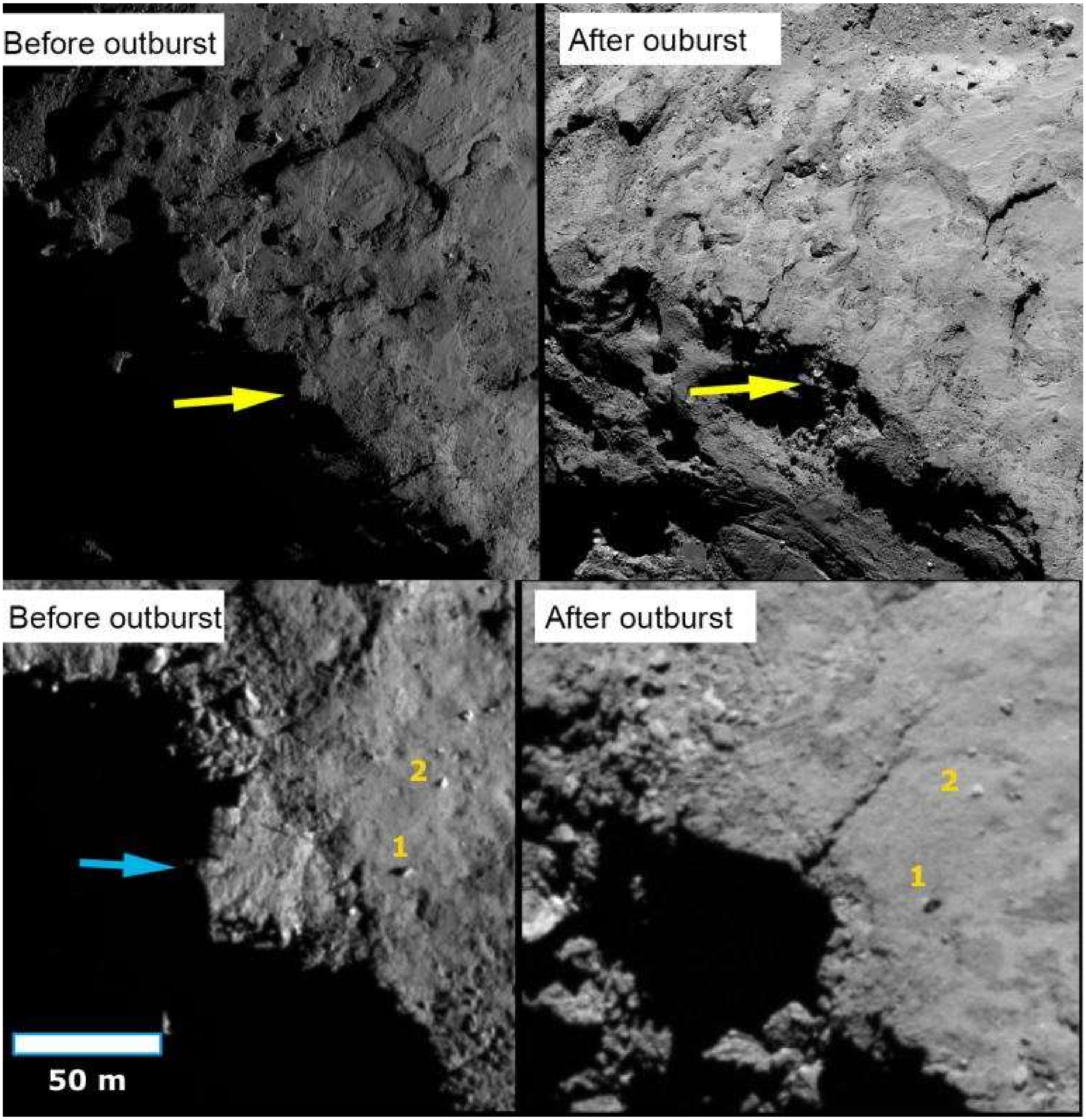


<Click to Enlarge> A graphic detailing the Aswan cliff collapse in July 2015. Two before images on the left, and two after images on the right. The center images shows a plume of dust leaving the comet at the time of the collapse. Image Credit: ESA/Rosetta/NavCam – CC BY-SA IGO 3.0; ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

But scientists think they've spotted an even larger cliff collapse. That one is linked to

This bright outburst came from the 2,000 sq. m. cliff collapse. Image Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA (CC BY-SA 4.0)

"Inspection of before and after images allow us to ascertain that the scarp was intact up until at least May 2015, for when we still have high enough resolution images in that region to see it," says Graham, an undergraduate student working with Ramy to investigate



Before and after a cliff collapse on Comet 67P/Churyumov-Gerasimenko. In the upper panels the yellow arrows show the location of a scarp at the boundary between the illuminated northern hemisphere and the dark southern hemisphere of the small lobe at times before and after the outburst event (September 2014 and June 2016, respectively). The lower panels show close-ups of the upper panels; the blue arrow points to the scarp that appears to have collapsed in the image after the outburst. Two boulders (1and 2) are marked for orientation. Image Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA (CC BY-SA 4.0)

When scientist examine debris on the comet closely, they find that the surrounding regions near the collapse probably suffered other large erosion events in the past. The blocks of debris are in variable sizes, some up to tens of meters in size. But the boulders from the observed Aswan cliff collapse are only a few meters in diameter.

“This variability in the size distribution of the fallen debris suggests either differences in the strength of the comet’s layered materials, and/or varying mechanisms of cliff collapse,” adds Ramy.

Scientists studying 67P say that observing large events like cliff collapses opens a window into the internal structure of the comet. That knowledge helps piece together the overall history of the comet’s formation.

scientist.

More:

- Press Release: Comet's Collapsing Cliffs And Bouncing Boulders
- ESA's Rosetta Mission
- Rosetta Image Archives
- Universe Today: Rosetta's 67P Is The Result Of A Collision Of Two Comets

ASTRONOMY, COMETS, SOLAR SYSTEM

67P, COMET 67P, COMET 67P/CHURYUMOV–GERASIMENKO, ROSETTA, ROSETTA MISSION, ROSETTA SPACECRAFT